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TESTING OF COLORIMETRIC TUBES FOR NITROGEN DIOXIDE AND MONOMETHYLHYDRAZINE

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McClellan Air Force Base, California

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13. ABSTRACT

Colorimetric tubes for nitrogen dioxide (NO_2) and monomethylhydrazine (MMH) were tested for accuracy and results indicate that at the levels checked the tubes' average deviation was ±20 percent. Tube NO_2 concentrations all read lower than the analyzed concentrations. MMH tubes read much higher than the analyzed concentration of 0.28 ppm but averaged <+20 percent deviation at the 1 to 2 ppm level.

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Colorimetric tubes for nitrogen dioxide (NO_2) and monomethylhydrazine (MMH) were tested for accuracy, and results indicate that at the levels checked the tubes' average deviation was ± 20 percent. Tube NO_2 concentrations all read lower than the analyzed concentrations. MMH tubes read much higher than the analyzed concentration of 0.28 ppm but averaged < + 20 percent deviation at the 1 to 2 ppm level.

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SECTION I

INTRODUCTION

Colorimetric gas detector tubes are used at Hill AFB and missile sites for monitoring propellant leaks from Post Boost Propulsion System of the Minuteman III missile. At the request of Capt R. Riccardi, Hill AFB, tests were performed to determine the accuracy of these tubes for NO_2 and MMH. Extensive testing of the accuracy and precision of these tubes has been performed by Rocketdyne, Autonetics (Ref. 1).

SECTION II

DETECTION SYSTEM

The detection system consists of two components. The Drager pump, a hand-operated bellows type with a capacity of 100 ml of air per stroke, is used to pull air through the detector tube. The tube for NO_2 effects a color change from white to blue grey and is based on the reaction of NO_2 with diphenylbenzidine. This indication is affected by free halogens. After a negative reaction, the tube may be used again for a second time on the same day.

The tube for MMH causes a color change from yellow to blue in the presence of MMH, and this change is caused by the basic properties of MMH. In addition to MMH, the tube indicates other air pollutants having a basic reaction such as hydrazine, derivatives of hydrazine, ammonia, and amines. This tube is to be used soon after opening and is not reusable after a negative test. Ten squeezes were taken for each sample for MMH and five squeezes for NO_2.

SECTION III

APPARATUS

The generator used for obtaining appropriate MMH concentrations is shown in Figure 1. The system used nitrogen to dilute as well as vaporize the MMH from an impinger because of the severe problem from air oxidation of this compound (Ref. 2). Samples were collected in an impinger containing appropriate sampling solution.

Permeation tubes were used for the generation of NO_2 concentrations as shown in Figure 2 because of their convenience and ability to provide a reliable steady concentration of NO_2 during the 10 minute sampling period with Saltzman's reagent being used as the absorption medium. Two "coarse" frits were used in series for the Saltzman procedure (Ref. 3). Figure 2 illustrates the generating and sampling procedure for NO_2. The temperature of the air-NO_2 mix was 73°, and the R. H. was 50 percent.

SECTION IV

ANALYSES

The concentrations of MMH or NO_2 vapors in the final air or nitrogen stream were determined by chemical analyses. The MMH was determined by the Watt and Chrisp (Ref. 4) method and NO_2 by the Saltzman method. Tubes received from Hill AFB had an expiration date of September 1971 and laboratory tubes had an expiration date of December 1971.

SECTION V

RESULTS

The results for MMH are shown in Table I:

TABLE I

TUBE READINGS AND ANALYTICAL RESULTS FOR MONOMETHYLHYDRAZINE

Analysis, ppm	September '71, ppm	December '71, ppm
0.28	0.4	0.45
0.92	1.2	1.0
2.35	2.5	2.1

The results for NO_2 are shown in Table II:

TABLE II

TUBE READINGS AND ANALYTICAL RESULTS FOR NO_2

Analysis, ppm (total)	September '71, ppm	December '71, ppm
2.7	2.0	1.75
6.3	5.5	4.50
9.05	8.75	7.00

Figures 3 and 4 graphically illustrate the results obtained.

SECTION VI

CONCLUSIONS

1. Limited studies on the MMH tubes indicate that low level readings are on the safe side and at levels of 1 and 2 ppm results average within the required ± 20 percent deviation.

2. The end point on the NO_2 tubes is difficult to read, but all results for NO_2 tubes were on the unsafe side. At 6.3 ppm the deviations from the analyzed concentration were -13 percent and -28 percent.

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4. Watt, G. W. and Chrisp, J. P., "A Spectrophotometric Method for the Determination of Hydrazine," Anal. Chem. (1952), 24, p. 2006.

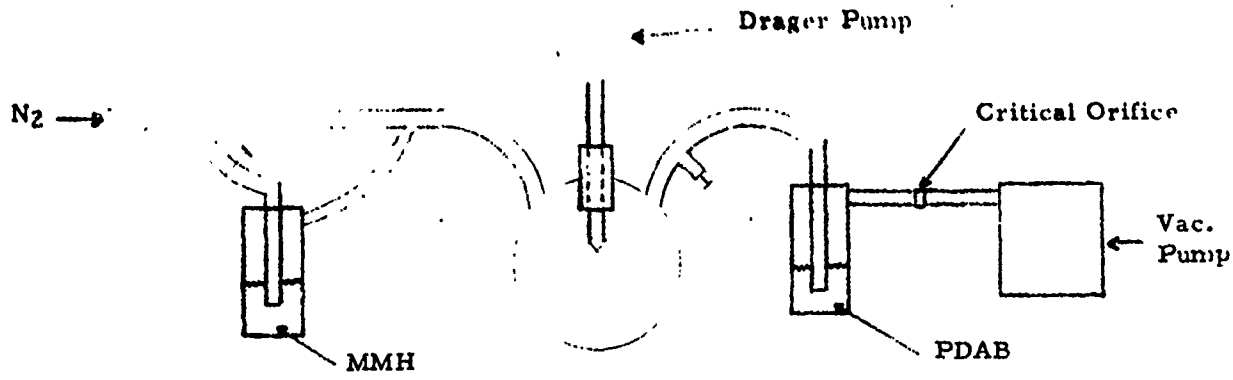


FIGURE 1. MMH Generator

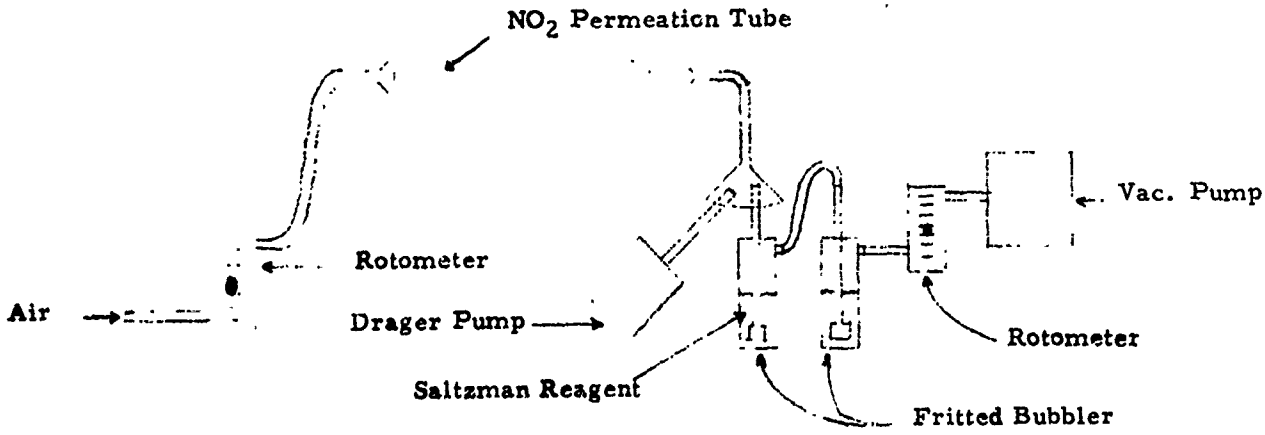


FIGURE 2. NO_2 Generator

Fig 3 Comparison of MMH Tubes to Chemical Analysis

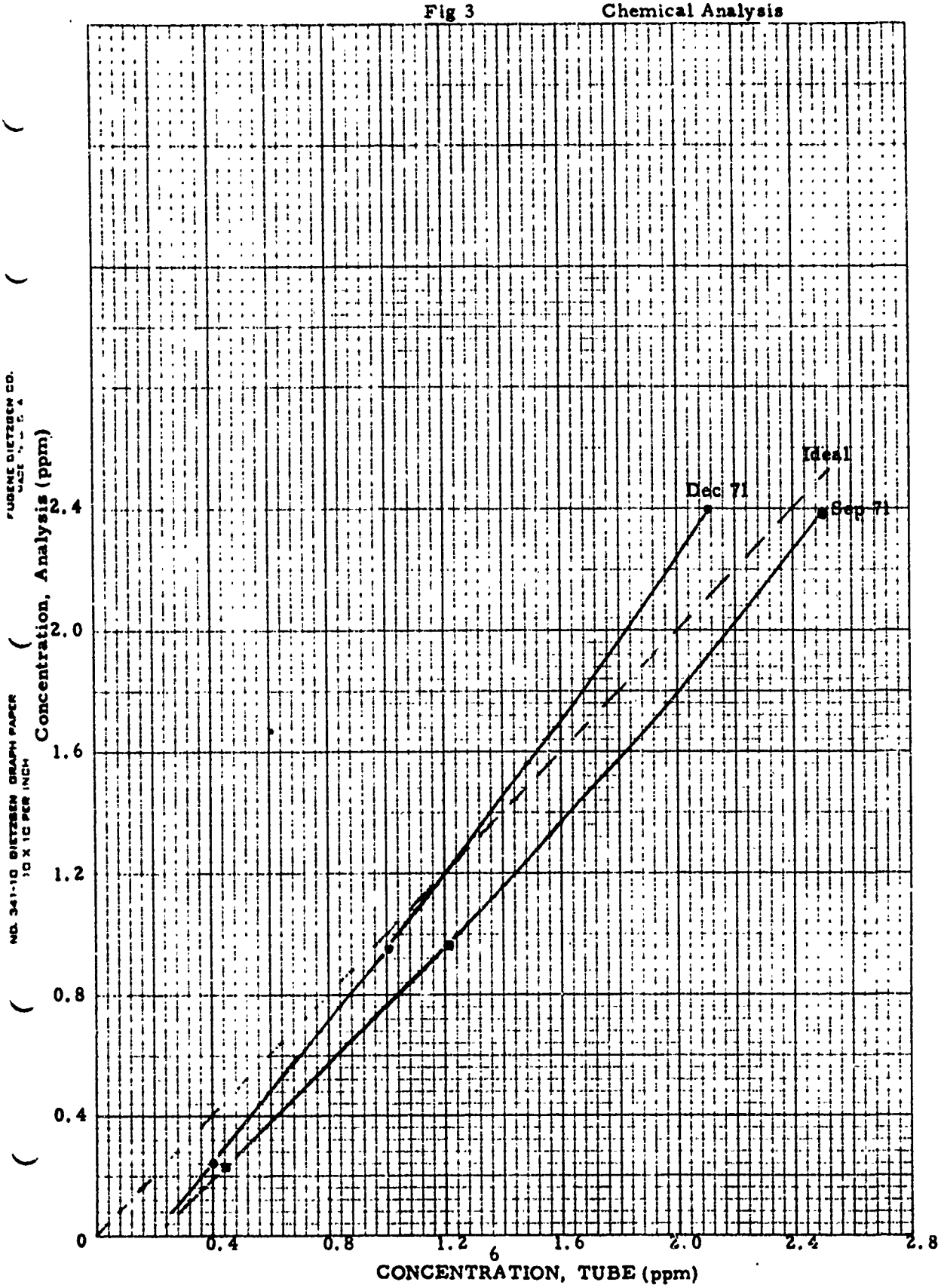
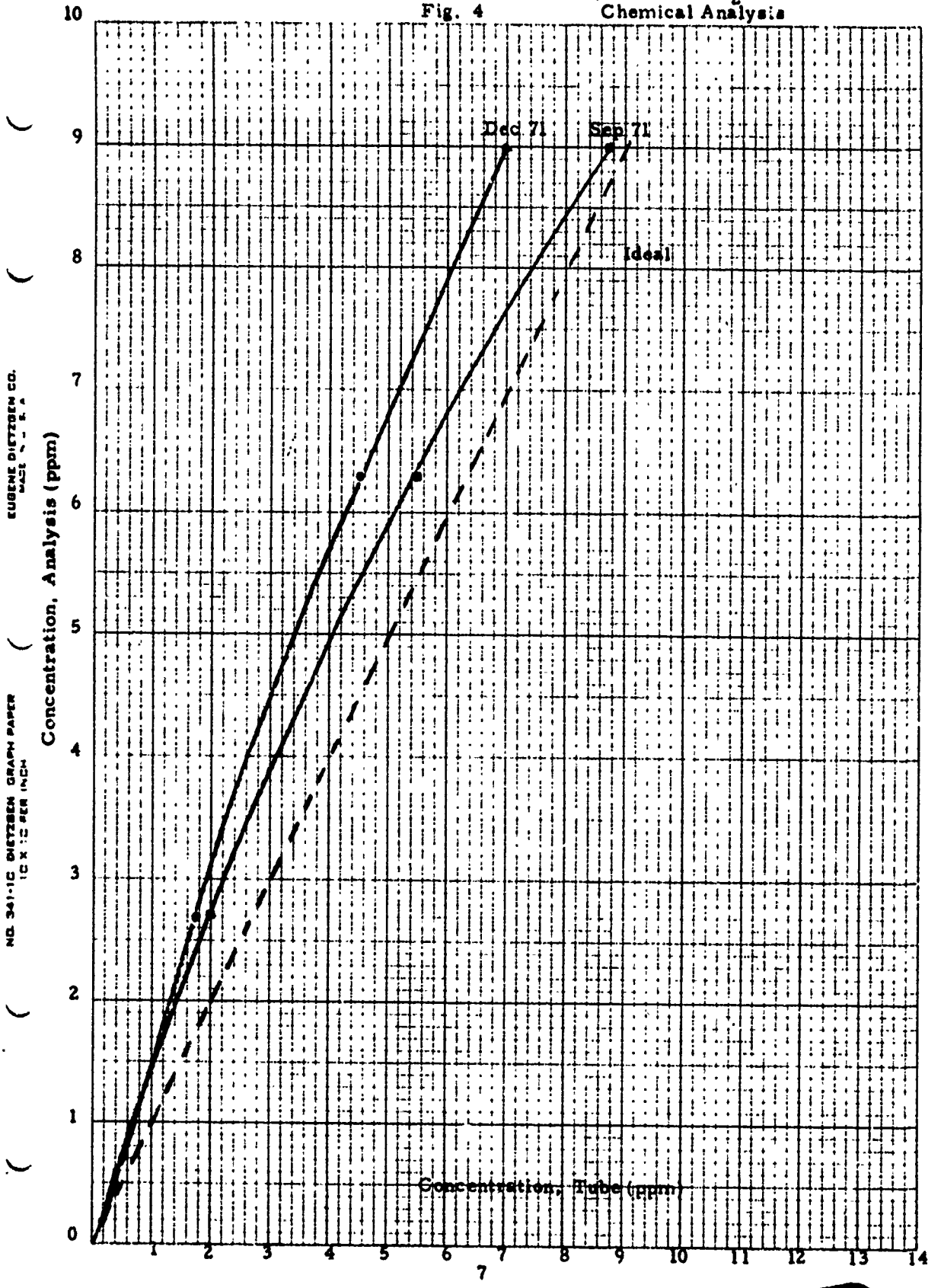


Fig. 4 Comparison of NO_2 Tubes to Chemical Analysis



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